University of Tripoli Faculty of Engineering Electrical and Electronic Department
Spring 2015 Final Exam **Signals & System (EE302)** Date: 25/06/2015 Time: 3Hrs
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Answer all questions:

[10]

Q1) a) sketch the following signals

i. $x(t) = 2.5r(0.5t + 1)$

ii. $x[n] = (n-2)(u[n-2] - u[n-6])$

b) Express the signals shown in terms of unit step and ram functions

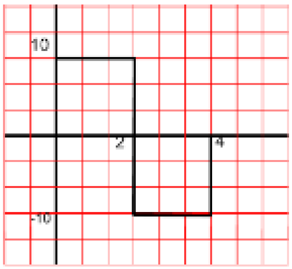


Fig.1

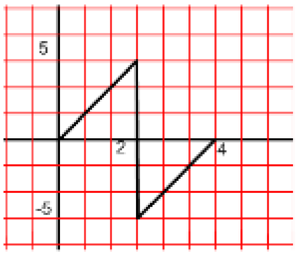


Fig.2

c) Evaluate the P_{av} *and E* for the following signals

i. $x_1(t) = 2\,r(t)$

ii. $x_2(t) = 4\cos(2\frac{\pi}{10}t)$

d) Determine if the following signals are periodic and find the period of each the signals if it is periodic

i. $x_1(t) = 6\cos\left(2\frac{\pi}{3}t\right) + 7\cos(\pi\sqrt{2}\,t)$

ii. $x2\,[n] = \cos^2[\frac{\pi}{8}n]$

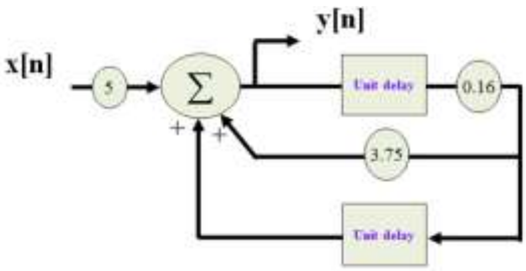
Q2)

a) Find the inverse Lapalce Transform of the following signal [10]

$$Y(s) = \frac{7s - 6}{(s^2 - s - 6)}$$

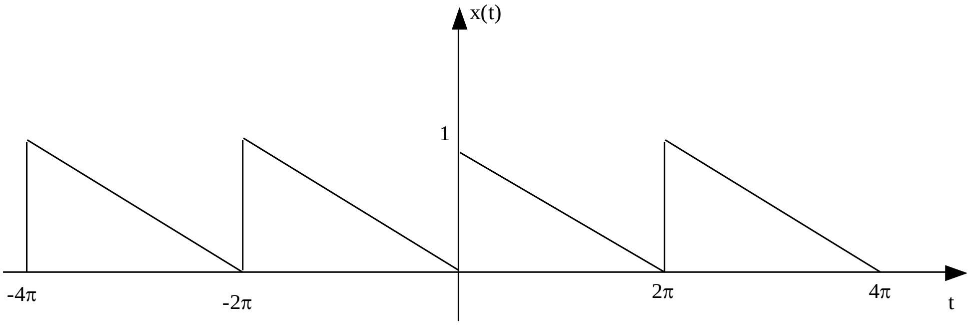
b) Given the following discrete system find the difference equation of the system and the output signal y[n]

If $x[n] = \delta[n]$ and $y[-1] = 0;\ y[0] = 5.$



Q3) Consider the shown periodic signal [10]

a) Determine the compact trigonometric Fourier Series
b) Determine the complex exponential Fourier series



Q4)

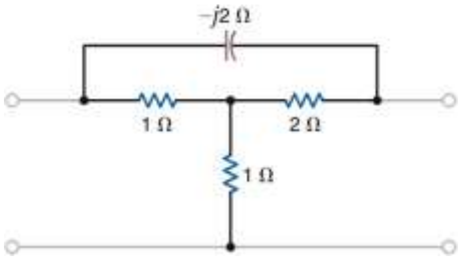
a) Verify the time shifting property $x(t-t_0) \leftrightarrow e^{-i\omega t}X(\omega)$ [8]
b) Consider a CLTI system described by

$$\frac{dy(t)}{dt} + 2y(t) = x(t)$$

Using the FT find the output y(t) to the input $x(t) = e^{-t}u(t)$

Q5) [10]

a) Verify the Laplace scaling property $x(at), a \geq 0 \leftrightarrow \frac{1}{a}X(\frac{s}{a})$
b) For the circuit shown, use the interconnected series network find the circuit impedance parameters



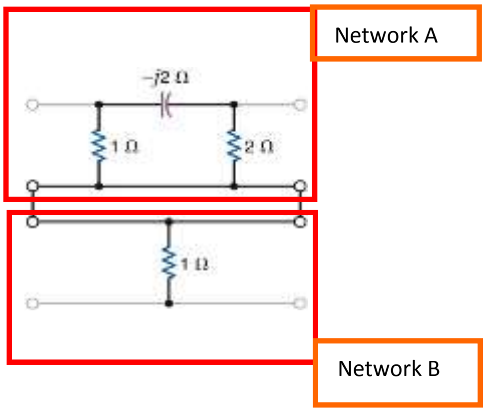


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TABLE 4.1 A Short Table of (Unilateral) Laplace Transforms

No.	$x(t)$	$X(s)$
1	$\delta(t)$	1
2	$u(t)$	$\frac{1}{s}$
3	$tu(t)$	$\frac{1}{s^2}$
4	$t^n u(t)$	$\frac{n!}{s^{n+1}}$
5	$e^{\lambda t} u(t)$	$\frac{1}{s-\lambda}$
6	$te^{\lambda t} u(t)$	$\frac{1}{(s-\lambda)^2}$
7	$t^n e^{\lambda t} u(t)$	$\frac{n!}{(s-\lambda)^{n+1}}$
8a	$\cos bt\, u(t)$	$\frac{s}{s^2+b^2}$
8b	$\sin bt\, u(t)$	$\frac{b}{s^2+b^2}$
9a	$e^{-at} \cos bt\, u(t)$	$\frac{s+a}{(s+a)^2+b^2}$
9b	$e^{-at} \sin bt\, u(t)$	$\frac{b}{(s+a)^2+b^2}$
10a	$re^{-at} \cos(bt+\theta)\, u(t)$	$\frac{(r\cos\theta)s + (ar\cos\theta - br\sin\theta)}{s^2+2as+(a^2+b^2)}$
10b	$re^{-at} \cos(bt+\theta)\, u(t)$	$\frac{0.5re^{j\theta}}{s+a-jb} + \frac{0.5re^{-j\theta}}{s+a+jb}$
10c	$re^{-at} \cos(bt+\theta)\, u(t)$ $r = \sqrt{\frac{A^2c+B^2-2ABa}{c-a^2}}$ $\theta = \tan^{-1}\left(\frac{Aa-B}{A\sqrt{c-a^2}}\right)$ $b = \sqrt{c-a^2}$	$\frac{As+B}{s^2+2as+c}$
10d	$e^{-at}\left[A\cos bt + \frac{B-Aa}{b}\sin bt\right]u(t)$ $b = \sqrt{c-a^2}$	$\frac{As+B}{s^2+2as+c}$